# THE NEWS LETTER
## OF THE
# BUREAU OF PUBLIC ROADS



VOL. 2, NO. 9 JULY, 1927 A. C. ROSE, EDITOR

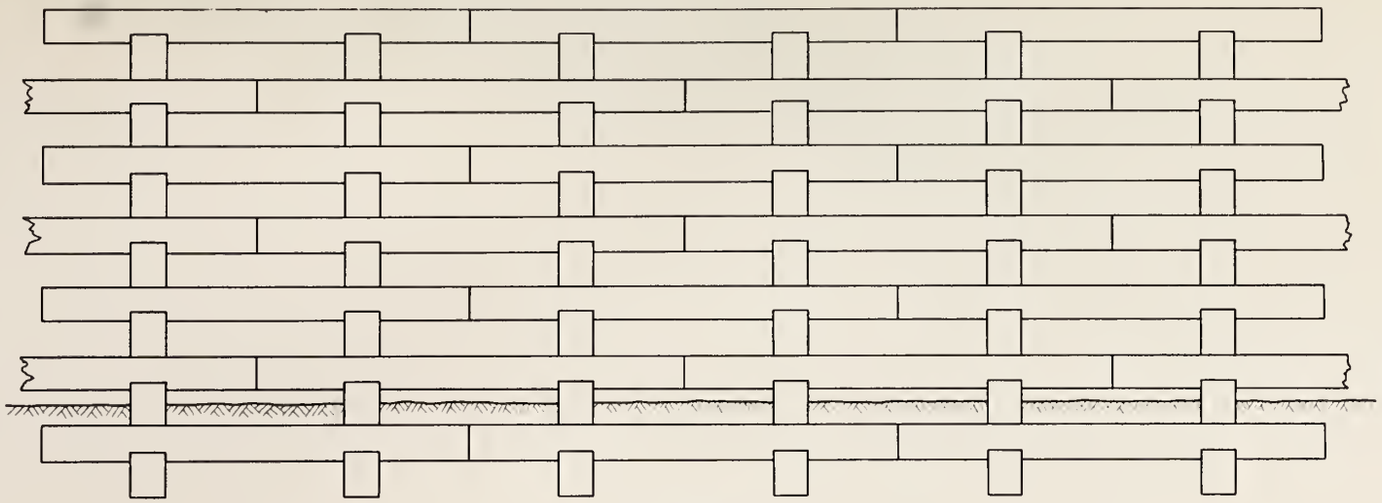
**CONTENTS**

# CONCRETE CRIBBING USED AS RETAINING WALL IN CONNECTICUT

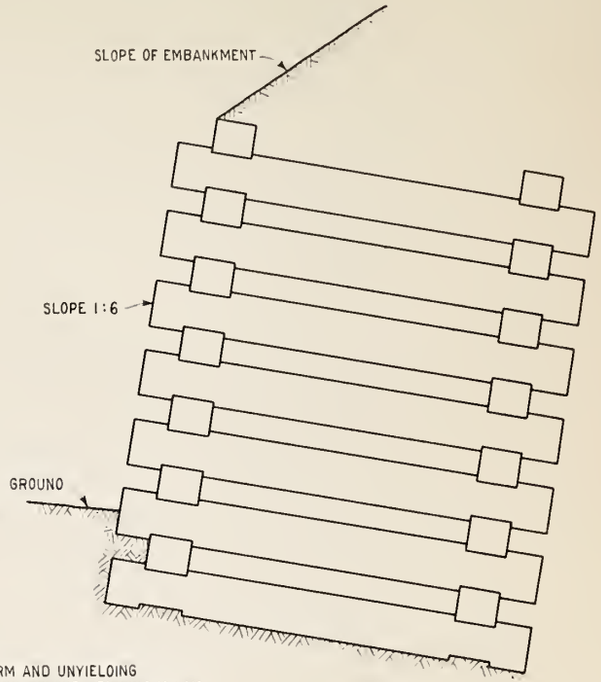
CONTRIBUTED BY H. G. MCKELVEY OF THE DIVISION OF CONSTRUCTION

CONCRETE CRIBBING, AS SHOWN IN THE ACCOMPANYING ILLUSTRATION, IS USED TO A CONSIDERABLE EXTENT BY THE CONNECTICUT STATE HIGHWAY COMMISSION AS A SUBSTITUTE FOR THE CUSTOMARY CONCRETE RETAINING WALL. THE CRIBBING TYPE OF CONSTRUCTION COSTS LESS, AND IS EASIER TO INSTALL, THAN A SOLID WALL. IT MAY BE USED EITHER TO RETAIN THE EMBANKMENT, OR THE SIDE SLOPE OF A ROAD IN EXCAVATION. IF THE CRIBBING IS NOT PLACED TO A SATISFACTORY HEIGHT WHEN FIRST BUILT; IT MAY, LATER, BE ADDED TO WITH LITTLE TROUBLE. IF THE SECTION OF ROAD, ON WHICH THE CRIBBING HAS BEEN USED, IS ABANDONED;

OR IF FOR ANY REASON, THE CRIBBING IS FOUND TO BE NO LONGER NECESSARY; THE TIES AND THE STRINGERS MAY BE REMOVED AT A MODERATE COST AND USED ELSEWHERE. THE INSTALLATION OF THE CRIBBING MAY BE ACCOMPLISHED BY A PICK-AND-SHOVEL CREW.

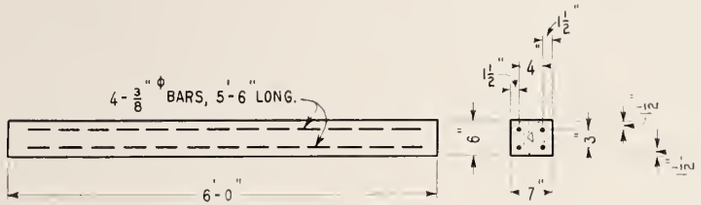


ELEVATION



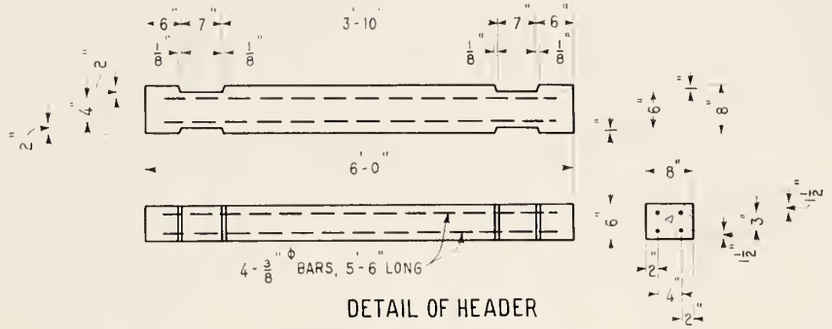

FOUNDATION TO BE FIRM AND UNYIELDING
AND MUST BE APPROVED BEFORE CRIBBING IS LAID.

CROSS-SECTION




DETAIL OF STRETCHER

MATERIAL FOR ONE STRETCHER
1.75 CU FT. CLASS "A" CONCRETE.
8.3 LBS. REINFORCING STEEL.




DETAIL OF HEADER

MATERIAL FOR ONE HEADER
1.90 CU FT. CLASS "A" CONCRETE.
8.3 LBS REINFORCING STEEL.

CRIBBING SHOULD BE FILLED WITH APPROVED MATERIAL IN LAYERS NOT OVER 12" THICK AND TAMPED IN A SATISFACTORY MANNER. THE ERECTION OF THE CRIBBING AND THE PLACING AND COMPACTING OF THE FILL SHOULD PROGRESS SIMULTANEOUSLY.

NOTE:
ALL CONCRETE TO BE CLASS "A" (1:2:4 MIX).
REINFORCING STEEL TO BE DEFORMED BARS OF AN APPROVED TYPE;
LEAST CROSS-SECTIONAL AREA EQUAL TO A PLAIN BAR OF THE SIZE SHOWN.

# TYPICAL CONCRETE CRIBBING

SCALE
1 1/2 0 1 2 3 FT

THE TIES AND STRINGERS ARE CAST, DURING THE SUMMER, AT THE STATE'S REPAIR SHOPS. THEY COST ABOUT $1.25 EACH. A SUPPLY OF SOME 12,000 OF THE BEAMS ARE MAINTAINED IN STORAGE TO TAKE CARE OF ANY EMERGENCY THAT MAY DEVELOP.

## A UNIQUE CONTRIVANCE FOR SCREENING AND LOADING GRAVEL SURFACING

CONTRIBUTED BY G. L. MCLANE, ASSOCIATE HIGHWAY ENGINEER OF DISTRICT 2

A UNIQUE CONTRIVANCE, FOR SCREENING AND LOADING GRAVEL, WAS USED IN PLACING A COMPARATIVELY SMALL AMOUNT OF SURFACING ON THE TELEGRAPH PASS CUT-OFF FEDERAL-AID PROJECT, ON THE PHOENIX-YUMA, ARIZ., ROUTE. THE CONTRIVANCE, ILLUSTRATED IN THE ACCOMPANYING PHOTOGRAPH, CONSISTED

OF A HOPPER, GRIZZLY, AND CHUTE, SUPPORTED BY SIX WOODEN POSTS. A POWER SHOVEL, WHICH HAD RECENTLY COMPLETED THE HEAVY ROCK CUTS ON THE PROJECT, WAS USED TO EXCAVATE THE GRAVEL FROM AN ALLUVIAL DEPOSIT, AND PLACE IT IN THE HOPPER. THE GRAVEL PIT, ADJACENT TO THE SLOPE OF A 15 TO 20-FOOT CUT, WAS SATISFACTORY, EXCEPT FOR THE LARGE PERCENTAGE OF OVER-SIZE MATERIAL.

The contractor believed that it would be economical to waste the over-size material provided the cost of handling could be reduced to a reasonable figure. The accuracy of the contractor's judgment was confirmed by the performance of the screening and loading device. The plant loaded 25 cubic yards of surfacing an hour. To accomplish this it was necessary to handle 34 to 38 cubic yards of pit-run material. The screened surfacing fell through the grizzly into the loading truck beneath; while the over-size material ran from the end of the chute into another truck, in which it was hauled a few hundred feet and then dumped to widen the embankment.

Crushed surfacing-material has been used only recently on Arizona projects; since it has been discovered that, in some cases, the cost of removing the over-size pit-run material, with fresnoes and teams, is in excess of the crushing charges. The use of pit-run material, in the special contrivance just described, effected a greater economy for the small amount of work done than would have been possible with a crushing plant.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

# STATUS OF CURRENT FEDERAL AID ROAD WORK

FOR THE FISCAL YEAR ENDING JUNE 30, 1927

AS OF JUNE 30, 1927

F.P.R.-F.A. No. 1
M-JUNE, 1927 - A

| STATES | BALANCE OF FEDERAL AID FUND AVAILABLE FOR NEW PROJECTS | * UNDER CONSTRUCTION | | | APPROVED FOR CONSTRUCTION | | | AMOUNT PAID STATES DURING FISCAL YEAR | COMPLETED AND PAID DURING FISCAL YEAR | | | AGREEMENTS NOW IN FORCE | | | P.S.& E. RECOMMENDED FOR APPROVAL BY DISTRICT ENGINEER | | | STATES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FEDERAL AID | MILES | | FEDERAL AID | MILES | | | FEDERAL AID | MILES | | FEDERAL AID | MILES | | FEDERAL AID | MILES | | |
| | | | ORIGINAL | STAGE | | ORIGINAL | STAGE | | | ORIGINAL | STAGE | | ORIGINAL | STAGE | | ORIGINAL | STAGE | |
| ALABAMA | $ 3,021,963.07 | $ 3,219,304.80 | 393.7 | 1.9 | $ 40,307.19 | 1.9 | | $ 1,206,220.03 | $ 889,114.85 | 101.9 | 4.6 | $ 3,210,396.64 | 392.1 | 1.9 | $ 49,215.35 | 3.6 | | ALABAMA |
| ARIZONA | 2,918,225.82 | 961,236.28 | 62.7 | 4.4 | 347,611.63 | 19.1 | | 721,244.42 | 583,396.92 | 71.0 | 0.4 | 1,291,583.47 | 81.8 | 4.4 | 17,264.44 | | | ARIZONA |
| ARKANSAS | 1,687,863.31 | 1,386,642.91 | 211.5 | | 284,001.03 | 19.4 | | 986,717.98 | 1,858,494.40 | 237.6 | | 1,400,285.52 | 221.9 | | 270,358.42 | 9.0 | | ARKANSAS |
| CALIFORNIA | 4,106,482.13 | 3,420,728.79 | 151.4 | 0.4 | 62,014.26 | 4.5 | | 2,978,864.97 | 3,963,434.52 | 248.3 | 17.3 | 3,454,295.68 | 155.5 | 0.4 | 28,447.37 | 0.4 | | CALIFORNIA |
| COLORADO | 2,673,436.36 | 3,074,539.39 | 276.1 | 9.1 | 20,057.34 | 2.9 | | 1,289,506.73 | 807,010.73 | 84.0 | | 2,566,804.38 | 222.6 | 9.1 | 527,792.35 | 56.4 | | COLORADO |
| CONNECTICUT | 694,246.11 | 1,478,079.22 | 63.9 | | 290,040.13 | 13.0 | | 613,841.51 | 343,414.74 | 20.2 | | 1,661,903.24 | 70.2 | | 106,216.11 | 6.7 | | CONNECTICUT |
| DELAWARE | 47,867.01 | 312,891.57 | 32.9 | 1.8 | 133,352.00 | 11.0 | | 450,337.15 | 563,906.82 | 35.2 | | 291,954.57 | 32.9 | | 154,289.00 | 11.0 | 1.9 | DELAWARE |
| FLORIDA | 1,060,766.31 | 3,897,634.31 | 196.3 | 24.8 | 398,091.78 | 24.2 | | 1,434,043.79 | 1,803,550.28 | 112.2 | | 3,539,607.71 | 190.3 | 24.8 | 756,116.38 | 30.2 | | FLORIDA |
| GEORGIA | 1,220,263.91 | 3,985,165.58 | 333.7 | 100.1 | 104,500.11 | 0.3 | 8.0 | 2,535,285.99 | 3,436,994.54 | 379.6 | 63.3 | 3,904,311.67 | 324.4 | 100.1 | 185,354.02 | 9.6 | 8.0 | GEORGIA |
| IDAHO | 639,297.36 | 1,650,659.48 | 199.1 | 17.4 | 129,336.00 | 9.3 | 0.1 | 1,235,844.70 | 1,193,414.46 | 110.8 | 13.1 | 1,405,945.79 | 181.9 | 16.6 | 374,049.69 | 26.5 | 0.8 | IDAHO |
| ILLINOIS | 2,702,710.43 | 4,867,016.84 | 356.8 | | 2,635,383.13 | 167.0 | | 2,427,392.92 | 2,161,520.86 | 153.1 | 2.0 | 4,119,966.92 | 308.7 | | 3,382,433.05 | 234.1 | | ILLINOIS |
| INDIANA | 379,107.70 | 7,567,438.31 | 476.9 | | 946,012.79 | 68.8 | 0.6 | 2,055,735.74 | 3,066,443.01 | 198.2 | 11.6 | 7,510,169.15 | 476.9 | | 1,003,281.95 | 68.8 | 0.6 | INDIANA |
| IOWA | 149,842.89 | 6,290,951.47 | 564.6 | 222.3 | 694,163.89 | 44.1 | 7.7 | 2,845,968.50 | 2,469,301.65 | 369.6 | 74.3 | 6,943,957.73 | 608.7 | 227.0 | 41,157.63 | | 3.0 | IOWA |
| KANSAS | 476,499.72 | 5,739,789.74 | 684.6 | 7.6 | 585,824.06 | 167.0 | 1.1 | 2,730,002.55 | 2,140,340.23 | 334.6 | 0.1 | 4,033,202.87 | 612.4 | 8.4 | 1,492,410.93 | 239.2 | 0.3 | KANSAS |
| KENTUCKY | 284,075.88 | 4,494,951.93 | 416.6 | 52.8 | 341,033.44 | 42.8 | 4.8 | 1,420,029.31 | 1,018,612.50 | 116.6 | 14.6 | 4,351,257.51 | 417.8 | 57.6 | 484,727.86 | 41.5 | | KENTUCKY |
| LOUISIANA | 947,557.36 | 1,935,266.43 | 140.9 | | 309,000.00 | 0.9 | | 1,124,502.53 | 949,152.22 | 122.8 | | 1,935,266.43 | 140.9 | | 309,000.00 | 0.9 | | LOUISIANA |
| MAINE | 1,250,418.90 | 992,794.43 | 74.8 | | 43,956.00 | 5.6 | | 878,953.95 | 665,945.28 | 54.0 | | 1,036,750.43 | 80.4 | | | | | MAINE |
| MARYLAND | 87,252.09 | 373,185.64 | 33.9 | | 574,800.00 | 66.6 | | 650,106.91 | 411,947.05 | 54.5 | | 373,185.64 | 33.9 | | 574,800.00 | 66.6 | | MARYLAND |
| MASSACHUSETTS | 2,196,417.16 | 1,540,245.89 | 92.9 | | 35,235.00 | 2.3 | | 799,464.35 | 768,667.53 | 35.9 | | 1,397,264.57 | 85.1 | | 178,416.12 | 10.1 | | MASSACHUSETTS |
| MICHIGAN | 2,235,102.66 | 5,428,748.35 | 365.3 | 12.6 | 664,720.00 | 26.3 | 6.5 | 2,692,098.35 | 2,501,432.69 | 121.2 | 25.7 | 4,994,642.35 | 356.6 | 12.8 | 993,826.00 | 36.0 | 6.5 | MICHIGAN |
| MINNESOTA | 550,476.43 | 2,112,898.90 | 370.0 | 115.7 | 3,000.00 | 19.4 | | 2,690,339.01 | 3,460,029.11 | 461.6 | 114.6 | 2,106,898.90 | 387.1 | 115.7 | 10,000.00 | 2.3 | | MINNESOTA |
| MISSISSIPPI | 777,765.71 | 3,268,980.98 | 383.7 | 14.8 | 384,875.69 | 65.2 | 14.6 | 1,589,120.64 | 1,589,760.52 | 135.1 | | 2,733,313.39 | 301.4 | | 870,523.28 | 127.5 | 29.3 | MISSISSIPPI |
| MISSOURI | 988,766.43 | 3,833,292.27 | 268.8 | 47.2 | 688,525.82 | 68.4 | 0.3 | 4,099,338.56 | 5,945,011.63 | 401.6 | 29.6 | 3,868,675.58 | 311.2 | 37.3 | 653,142.41 | 24.0 | 10.2 | MISSOURI |
| MONTANA | 4,387,225.95 | 1,426,969.48 | 129.8 | 5.7 | 1,874,899.88 | 305.9 | 3.4 | 894,779.83 | 953,822.80 | 96.7 | 62.6 | 3,199,376.63 | 426.6 | 9.0 | 102,332.53 | 15.1 | | MONTANA |
| NEBRASKA | 1,072,492.57 | 6,216,961.27 | 1305.1 | 639.1 | 1,191,542.77 | 186.6 | 227.5 | 2,370,258.28 | 2,265,183.87 | 478.3 | 238.6 | 6,190,589.35 | 1262.5 | 720.4 | 1,227,904.69 | 205.2 | 136.2 | NEBRASKA |
| NEVADA | 840,196.65 | 1,314,359.67 | 182.7 | 26.2 | | | | 1,083,652.86 | 2,458,234.09 | 314.8 | 11.0 | 1,306,743.96 | 182.7 | 26.2 | 8,515.72 | | | NEVADA |
| NEW HAMPSHIRE | 142,799.26 | 460,853.90 | 30.8 | | 152,536.79 | 8.8 | | 424,768.85 | 401,477.98 | 27.2 | | 449,707.26 | 30.1 | | 163,682.41 | 9.6 | | NEW HAMPSHIRE |
| NEW JERSEY | 117,647.96 | 1,700,398.66 | 111.3 | | 88,620.00 | 5.9 | | 732,592.69 | 2,397,022.27 | 26.0 | | 1,414,258.56 | 92.2 | | 374,760.00 | 25.0 | | NEW JERSEY |
| NEW MEXICO | 1,635,135.72 | 2,686,415.22 | 233.6 | | | | | 1,110,390.27 | 597,940.68 | 78.2 | | 1,915,834.29 | 216.1 | | 667,580.93 | 17.5 | | NEW MEXICO |
| NEW YORK | 4,100,934.90 | 9,416,593.95 | 579.8 | | 2,468,927.50 | 155.6 | 8.6 | 4,367,134.87 | 3,781,998.46 | 242.3 | | 10,806,428.95 | 668.4 | | 1,079,092.50 | 67.0 | 8.6 | NEW YORK |
| NORTH CAROLINA | 965,763.17 | 1,296,705.92 | 87.6 | | 649,189.75 | 36.8 | 27.9 | 2,441,688.30 | 3,341,585.22 | 202.2 | 37.5 | 1,296,705.92 | 87.6 | | 649,189.76 | 36.8 | 27.9 | NORTH CAROLINA |
| NORTH DAKOTA | 440,187.20 | 2,825,402.96 | 738.9 | 160.8 | 931,726.17 | 320.8 | 249.6 | 2,530,261.21 | 1,714,433.90 | 522.5 | 362.9 | 2,940,743.64 | 714.9 | 309.1 | 816,385.48 | 344.9 | 101.3 | NORTH DAKOTA |
| OHIO | 4,351,646.92 | 4,484,341.32 | 334.3 | 4.2 | 326,640.00 | 20.8 | | 2,580,502.50 | 1,959,589.73 | 150.9 | 13.4 | 4,366,289.62 | 326.0 | 4.2 | 441,691.70 | 29.1 | | OHIO |
| OKLAHOMA | 1,494,408.94 | 1,714,249.20 | 261.2 | 23.0 | 485,430.65 | 71.5 | 15.6 | 1,339,252.44 | 957,590.06 | 89.2 | 10.1 | 2,003,622.45 | 272.3 | 38.6 | 196,057.40 | 50.4 | | OKLAHOMA |
| OREGON | 718,329.08 | 1,276,070.18 | 62.4 | 35.8 | 25,696.80 | 9.9 | | 1,301,855.33 | 1,448,238.15 | 115.8 | | 1,212,761.93 | 67.6 | 35.8 | 89,005.05 | 4.8 | | OREGON |
| PENNSYLVANIA | 2,219,530.44 | 4,890,636.70 | 323.1 | | 1,246,728.54 | 64.2 | | 3,180,313.25 | 4,756,888.28 | 345.5 | | 5,226,777.77 | 343.0 | | 910,587.47 | 44.3 | | PENNSYLVANIA |
| RHODE ISLAND | 643,321.20 | 338,055.00 | 22.6 | | 153,338.74 | 9.3 | | 466,586.24 | 439,650.00 | 29.3 | | 443,475.00 | 29.6 | | 47,918.74 | 2.3 | | RHODE ISLAND |
| SOUTH CAROLINA | 400,621.80 | 2,799,135.49 | 235.8 | 19.2 | 129,766.91 | 22.9 | | 1,187,023.41 | 760,665.87 | 86.5 | 15.4 | 2,589,157.51 | 220.5 | 14.0 | 339,743.89 | 38.2 | | SOUTH CAROLINA |
| SOUTH DAKOTA | 572,660.78 | 1,913,591.91 | 623.6 | 38.2 | 393,185.77 | 131.5 | 80.5 | 1,074,687.39 | 903,698.57 | 321.7 | 154.4 | 2,009,474.41 | 681.3 | 72.7 | 297,303.27 | 73.8 | 46.0 | SOUTH DAKOTA |
| TENNESSEE | 1,729,212.38 | 3,614,687.07 | 226.7 | 60.4 | | | | 1,793,804.55 | 1,274,873.53 | 88.7 | 19.1 | 3,278,903.78 | 202.7 | 42.8 | 335,783.29 | 23.0 | 17.6 | TENNESSEE |
| TEXAS | 6,185,704.19 | 6,770,640.89 | 535.1 | 200.2 | 580,397.47 | 54.7 | 28.1 | 4,710,228.42 | 4,126,705.73 | 546.2 | 39.8 | 6,874,147.13 | 524.8 | 212.9 | 476,891.23 | 65.0 | 15.4 | TEXAS |
| UTAH | 711,346.79 | 1,748,044.39 | 173.6 | | 439,213.87 | 37.6 | | 830,082.69 | 668,639.27 | 82.5 | | 1,690,968.53 | 172.2 | | 496,289.73 | 38.9 | | UTAH |
| VERMONT | 42,607.86 | 819,113.52 | 41.7 | | 423,554.61 | 27.4 | | 625,423.73 | 331,166.60 | 18.2 | | 715,793.52 | 34.8 | | 526,874.61 | 34.3 | | VERMONT |
| VIRGINIA | 74,673.64 | 1,976,028.87 | 109.4 | | 357,382.24 | 19.0 | 4.0 | 1,868,896.29 | 2,151,416.14 | 163.4 | | 2,039,623.15 | 111.3 | 4.0 | 292,787.96 | 17.1 | | VIRGINIA |
| WASHINGTON | 1,215,156.05 | 1,750,600.00 | 68.2 | | 66,000.00 | 10.1 | | 1,146,672.36 | 463,642.49 | 42.5 | | 1,770,600.00 | 71.8 | | 45,000.00 | 6.5 | | WASHINGTON |
| WEST VIRGINIA | 312,470.32 | 2,934,191.85 | 238.2 | 12.0 | 325,736.82 | 26.9 | | 648,202.63 | 432,685.36 | 26.6 | | 2,841,704.96 | 237.1 | 12.0 | 418,223.71 | 28.0 | | WEST VIRGINIA |
| WISCONSIN | 2,660,332.30 | 4,592,758.80 | 375.5 | 36.2 | 308,320.00 | 19.4 | 16.2 | 2,357,068.64 | 1,465,153.17 | 137.4 | 7.8 | 4,115,089.80 | 336.3 | 31.0 | 785,989.00 | 58.6 | 19.4 | WISCONSIN |
| WYOMING | 804,279.00 | 1,557,096.95 | 177.5 | 66.9 | | | | 696,804.42 | 1,098,380.00 | 182.4 | 32.8 | 1,083,316.66 | 111.6 | 33.7 | 473,781.29 | 65.9 | 32.2 | WYOMING |
| HAWAII | 805,975.36 | 562,362.64 | 29.7 | | | | | 253,061.09 | 97,440.00 | 6.5 | | 562,362.64 | 29.7 | | | | | HAWAII |
| TOTALS | $ 69,440,956.18 | $142,817,679.01 | 13355.1 | 1968.8 | $ 22,233,674.67 | 2395.8 | 704.1 | $ 81,371,013.03 | $ 83,828,987.66 | 8431.0 | 1376.6 | $141,316,896.87 | $13442.2 | 2162.3 | $ 23,734,456.71 | 2308.6 | 495.2 | TOTALS |

* INCLUDES PROJECTS REPORTED COMPLETED (FINAL VOUCHERS NOT YET PAID) TOTALING: FEDERAL AID $34,877,220.48; MILEAGE ORIGINAL 3262.1; MILES STAGE 746.5

(Not for release)

# COMMENTS ON THE 1927 MEETING OF THE A. S. T. M.

Contributed by F. H. Jackson of the Division of Tests

The 30th annual meeting of the American Society for Testing Materials, held at the French Lick Springs Hotel, French Lick, Indiana, during the week of June 20-25, was a memorable one in several respects. The meeting, in addition to marking the twenty-fifth anniversary of the incorporation of the society, was the first ever held west of the Alleghany mountains. For this reason, a considerably larger proportion of the western members than usual attended the various sessions. Highway testing engineers from most of the Mississippi Valley States were in attendance. The Bureau was represented by Messrs. E. F. Kelley, L. W. Teller, F. H. Jackson, and W. J. Emmons, of the Division of Tests.

In addition to the many features of general interest to the representatives of the Bureau, there were several sessions and many committee meetings dealing with subjects of direct interest to the highway engineer. Of perhaps outstanding interest may be mentioned the symposium, on "Field Control of the Quality of Concrete", presented during the final session. Several papers dealing with particular phases of this problem were presented by outstanding authorities such as D. A. Abrams, H. S. Mattimore, R. B. Young, and R. W. Crum. A very interesting discussion followed the presentation of the symposium. This discussion centered largely on what constitutes the most significant strength test for concrete. The subject is of considerable importance to the highway testing engineer at the present time.

Other sessions of interest included the sessions on cement, road materials, corrosion of metals, etc. At these sessions several changes in the standard methods of testing road materials were approved. These included changes in the standard method of making the mechanical analysis of sand, the standard method of test for the distillation of bituminous materials, the standard method of test for the unit weight of aggregates for

CONCRETE, THE STANDARD METHOD OF MAKING AND STORING CONCRETE IN THE FIELD, THE STANDARD METHOD OF TESTS FOR VOIDS IN FINE AGGREGATE FOR CONCRETE, AND THE STANDARD METHOD OF MAKING THE COMPRESSION TEST OF CONCRETE.

AT THE MEETING OF THE COMMITTEE ON CEMENT, THE RESULTS OF PROBABLY THE LARGEST SERIES OF CHECK TESTS OF CEMENT, EVER CONDUCTED IN THIS COUNTRY, WERE PRESENTED BY MR. H. F. GONNERMAN OF THE PORTLAND CEMENT ASSOCIATION. THESE TESTS WERE MADE BY OVER FORTY TESTING LABORATORIES, ON THIRTY-TWO BRANDS OF PORTLAND CEMENT, FOR THE PURPOSE OF DETERMINING THE RELATIVE CONCORDANCE OF THE PRESENT STANDARD METHODS OF TESTING AS COMPARED TO A PROPOSED METHOD OF TEST, WHICH INVOLVES THE USE OF NEAT CEMENT OF FLUID CONSISTENCY IN THE FORM OF A 2-INCH CUBE, INSTEAD OF THE STANDARD BRIQUETTE. A DETAILED REPORT OF THE RESULTS OF THESE TESTS WILL BE PUBLISHED IN THE NEAR FUTURE.

ANOTHER MEETING OF INTEREST TO HIGHWAY ENGINEERS WAS THE ORGANIZATION MEETING OF THE NEWLY FORMED SUBCOMMITTEE ON SCREENS OF THE COMMITTEE ON METHODS OF TESTS. THIS COMMITTEE HAS BEEN CHARGED WITH THE DUTY OF STANDARDIZING, IF POSSIBLE, THE SHAPE OF THE APERTURE IN TESTING SCREENS FOR LARGE-SIZED AGGREGATES, SUCH AS CRUSHED STONE, SLAG, GRAVEL, ETC. ALL TESTING ENGINEERS ARE FAMILIAR WITH THE CONFUSION RESULTING FROM THE PRESENT METHOD OF HAVING BOTH ROUND-HOLE AND SQUARE-MESH SIEVES IN USE.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

M-1 (1926)
R S A

## STATE HIGHWAY SYSTEMS (1)

### MILEAGE BUILT TO GRADE AND MILES SURFACED DURING 1926 (2)

| STATES. (YEAR ENDS DECEMBER 31 EXCEPT AS NOTED) | TOTAL OF MILES GRADED & MILES SURFACED | EARTH IMPROVED GRADED & DRAINED (4) | NEW SURFACING PLACED (3) TOTAL (5) | ON EARTH ROADS (5) | ON WORN OUT OTHER TYPES | ON WORN OUT SAME TYPE (RECON) | SAND-CLAY AND TOP SOIL NEW | SAND-CLAY AND TOP SOIL RECON. | GRAVEL, ETC. TREATED AND UNTREATED NEW | GRAVEL, ETC. TREATED AND UNTREATED RECON. | WATERBOUND MACADAM TREATED & UNTREATED NEW | WATERBOUND MACADAM TREATED & UNTREATED RECON | BITUMINOUS MACADAM BY PENETRATION NEW | BITUMINOUS MACADAM BY PENETRATION RECON | SHEET ASPHALT NEW | SHEET ASPHALT RECON | BITUMINOUS CONCRETE NEW | BITUMINOUS CONCRETE RECON | PORTLAND CEMENT CONCRETE NEW | PORTLAND CEMENT CONCRETE RECON | VITRIFIED BRICK NEW | VITRIFIED BRICK RECON | BLOCK: ASPHALT, WOOD, STONE RECON. | REVISION OF SURFACED MILEAGE (6) | STATES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALABAMA (7) | 495.9 | 28.7 | 467.2 | 346.5 | 113.7 | 7.0 | 44.0 | - | 350.3 | 7.0 | - | - | 7.9 | - | - | - | 0.3 | - | 57.7 | - | - | - | - | -7.0 | ALABAMA |
| ARIZONA | 113.3 | 38.3 | 75.0 | 60.8 | 9.0 | 6.2 | - | - | 59.2 | 5.2 | - | - | 9.5 | - | - | - | 4.0 | - | 1.0 | - | - | - | - | - 91.8 | ARIZONA |
| ARKANSAS | 874.0 | 516.0 | 358.0 | 358.0 | - | - | - | - | 429.0 | - | - | - | - | - | - | - | - | - | 2.0 | - | - | - | - | - | ARKANSAS |
| CALIFORNIA | 265.4 | - | 265.4 | 158.9 | 65.1 | 41.4 | - | - | 164.7 | 15.5 | - | - | 2.1 | 6.9 | - | - | 35.3 | 5.3 | 21.9 | 13.7 | - | - | - | -4.3 | CALIFORNIA |
| COLORADO | 406.9 | 111.6 | 295.3 | 42.6 | 26.7 | 226.1 | 6.9 | - | 35.6 | 226.1 | - | - | - | - | - | - | - | - | 26.7 | - | - | - | - | - | COLORADO |
| CONNECTICUT (8) | 200.6 | 0.6 | 200.0 | 107.5 | 73.7 | 18.8 | - | - | 1.7 | 2.3 | 90.8 | 13.8 | 27.1 | - | - | - | 25.5 | 2.7 | 36.0 | - | 0.1 | - | - | -13.2 | CONNECTICUT |
| DELAWARE | 84.8 | | 84.8 | 79.8 | 5.0 | - | - | - | 22.0 | - | - | - | - | - | 5.8 | - | 1.0 | - | 56.0 | - | - | - | - | + 5.0 | DELAWARE |
| FLORIDA | 358.0 | 8.5 | 349.5 | 257.0 | 90.2 | 2.3 | 126.1 | - | - | - | 186.8 | - | 1.3 | - | 16.5 | 2.3 | 0.2 | - | 16.3 | - | - | - | - | -76.6 | FLORIDA |
| GEORGIA | 386.7 | 59.1 | 327.6 | 192.5 | 73.0 | 62.1 | 104.9 | - | 89.0 | 62.1 | - | - | 27.4 | - | 11.9 | - | - | - | 32.3 | - | - | - | - | - 0.5 | GEORGIA |
| IDAHO | 373.0 | 103.6 | 289.4 | 241.2 | 22.1 | 8.1 | - | - | 232.6 | 6.1 | - | - | - | - | - | - | 27.3 | - | 3.4 | - | - | - | - | - | IDAHO |
| ILLINOIS | 407.5 | 45.7 | 361.8 | 358.6 | 0.1 | 3.1 | - | - | - | - | - | - | - | - | - | - | - | - | 352.3 | 3.1 | 6.4 | - | - | - | ILLINOIS |
| INDIANA | 385.1 | 9.4 | 378.7 | 88.2 | 211 2 | 77.3 | - | - | 5.4 | 40.8 | 57.9 | 38.5 | 38.9 | - | - | - | 2.2 | - | 195.0 | - | - | - | - | +206.7 | INDIANA |
| IOWA | 993.8 | 495.1 | 498.7 | 447.0 | 18.7 | 35.0 | - | - | 372.6 | 35.0 | - | - | - | - | - | - | - | - | 91.1 | - | - | - | - | - 6.8 | IOWA |
| KANSAS | 1,475.5 | (9)1,072.0 | 403.5 | 375.7 | - | 27.8 | 255.0 | - | 38.0 | - | - | - | 10.0 | 27.9 | - | - | - | - | 57.0 | - | 15.7 | - | - | - | KANSAS |
| KENTUCKY (8) | 434.8 | 237.2 | 197.8 | 91.9 | 32.2 | 73.5 | - | - | 62.3 | 27.2 | 1.7 | 46.3 | 24.9 | - | - | - | - | - | 36.2 | - | - | - | - | +1,827.9 | KENTUCKY |
| LOUISIANA | 594.5 | - | 594.5 | 586.0 | 8.5 | - | - | - | 578.7 | - | - | - | - | - | 0.5 | - | 13.3 | - | 2.0 | - | - | - | - | + 299.5 | LOUISIANA |
| MAINE | 135.1 | - | 135.1 | 87.4 | 22.3 | 25.4 | - | - | 69.7 | 25.4 | - | - | 23.1 | - | - | - | - | - | 16.9 | - | - | - | - | - | MAINE |
| MARYLAND (7) | 148.1 | - | 148.1 | 126.4 | 19.1 | 2.6 | - | - | 23.6 | - | 19.6 | 1.1 | - | - | 3.3 | - | 12.6 | - | 86.4 | 1.5 | - | - | - | + 17.6 | MARYLAND |
| MASSACHUSETTS (10) | 102.8 | - | 102.8 | 8.8 | 76.1 | 17.9 | - | - | 0.5 | 0.6 | - | - | 41.7 | 16.9 | - | - | 12.6 | 0.1 | 30.1 | - | - | - | (11) 0.4 | + 13.0 | MASSACHUSETTS |
| MICHIGAN | 354.1 | - | 354.1 | 208.8 | 128.0 | 19.3 | - | - | 138.6 | 15.2 | - | 0.1 | 0.6 | - | - | - | 22.1 | - | 173.5 | 4.0 | - | - | - | - 5.1 | MICHIGAN |
| MINNESOTA | 1,727.8 | 315.8 | 1,412.0 | 443.5 | 180.2 | 788.3 | - | - | 443.5 | 788.3 | - | - | - | - | - | - | 4.9 | - | 174.9 | - | 0.4 | - | - | - 68.7 | MINNESOTA |
| MISSISSIPPI | 584.3 | 125.7 | 458.6 | 453.5 | 1.1 | 4.0 | - | - | 439.8 | 4.0 | - | - | - | - | 0.3 | - | - | - | 14.7 | - | - | - | - | +695.8 | MISSISSIPPI |
| MISSOURI | 1,187.2 | 344.6 | 822.7 | 822.7 | - | - | - | - | 342.7 | - | - | - | - | - | - | - | - | -- | 480.0 | - | - | - | - | - | MISSOURI |
| MONTANA | 124.2 | 5.0 | 119.2 | 67.5 | - | 51.7 | - | - | 101.7 | 51.7 | - | -- | - | - | - | - | 1.5 | - | - | - | - | - | - | - | MONTANA |
| NEBRASKA | 1,476.9 | 642.1 | 833.8 | 833.8 | - | - | 128.5 | - | 693.3 | - | - | - | - | - | 0.5 | - | 1.3 | - | 10.2 | - | - | - | - | - | NEBRASKA |
| NEVADA | 200.3 | 10.6 | 189.7 | 151.7 | - | 38.0 | - | - | 151.7 | 38.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | -2.7 | NEVADA |
| NEW HAMPSHIRE | 195.7 | 16.3 | 169.4 | 139.8 | 21.7 | 7.9 | - | - | 129.6 | 7.6 | 8.8 | - | 15.0 | - | - | - | 5.4 | 0.3 | 2.7 | - | - | - | - | + 2.2 | NEW HAMPSHIRE |
| NEW JERSEY | 53.7 | 3.2 | 50.5 | - | 50.5 | - | - | - | - | - | - | - | - | - | 0.4 | - | - | - | 60.1 | - | - | - | - | +115.0 | NEW JERSEY |
| NEW MEXICO | 481.9 | 408.0 | 73.9 | 68.6 | 0.3 | 5.0 | - | - | 67.0 | 5.0 | - | - | - | - | - | - | - | - | 1.9 | - | - | - | - | - | NEW MEXICO |
| NEW YORK | 581.3 | 15.7 | 565.8 | 288.4 | 264.2 | 15.0 | - | - | 21.2 | - | 3.5 | - | 40.3 | 15.0 | - | - | 8.2 | - | 477.4 | - | - | - | - | - | NEW YORK |
| NORTH CAROLINA | 1,091.5 | 395.4 | 696.2 | 72.4 | 623.8 | - | 78.1 | - | 14.1 | - | 21.4 | - | 60.1 | - | 2.4 | - | 82.5 | - | 437.5 | - | - | - | - | - | NORTH CAROLINA |
| NORTH DAKOTA | 977.3 | 437.9 | 539.4 | 531.9 | - | 7.6 | - | - | 529.5 | 7.5 | - | - | - | - | 0.7 | - | - | - | 1.7 | - | - | - | - | - | NORTH DAKOTA |
| OHIO | 2,480.9 | 69.6 | 2,411.2 | 1,426.9 | 436.8 | 648.5 | - | - | 1,483.3 | 229.5 | 42.4 | 177.4 | 122.1 | 46.2 | 7.3 | 1.0 | 11.6 | 2.8 | 142.4 | 39.8 | 53.6 | 52.0 | - | +939.9 | OHIO |
| OKLAHOMA | 436.5 | 200.4 | 236.1 | 236.1 | - | - | - | - | 129.4 | - | - | - | - | - | - | - | - | - | 102.6 | - | 4.2 | - | - | - | OKLAHOMA |
| OREGON | 374.6 | 81.0 | 293.6 | 240.4 | 13.1 | 40.1 | - | - | 776.6 | 40.1 | - | - | - | - | - | - | 3.3 | - | 9.7 | - | - | - | - | - 28.4 | OREGON |
| PENNSYLVANIA | 1,045.0 | 293.7 | 751.3 | 504.2 | 178.2 | 68.9 | - | - | 12.6 | 3.3 | 214.4 | 69.9 | 12.9 | 0.4 | 0.2 | 4.8 | 10.7 | 0.1 | 430.8 | 0.3 | 0.8 | 0.1 | - | +392.8 | PENNSYLVANIA |
| RHODE ISLAND | 49.9 | - | 49.9 | 31.7 | 18.2 | - | - | - | 3.5 | - | 6.9 | - | 19.9 | - | 1.8 | - | 2.6 | - | 15.2 | - | - | - | - | + 14.0 | RHODE ISLAND |
| SOUTH CAROLINA | 632.0 | 47.9 | 584.1 | 467.8 | 100.3 | 16.0 | 345.4 | - | 150.4 | 16.0 | - | - | - | - | 9.1 | - | 38.2 | - | 25.0 | - | - | - | - | +181.3 | SOUTH CAROLINA |
| SOUTH DAKOTA | 472.9 | 28.1 | 444.8 | 442.9 | 1.9 | (12) | - | - | 442.9 | (12) | - | - | - | - | - | - | - | - | 1.9 | - | - | - | - | + 1.9 | SOUTH DAKOTA |
| TENNESSEE | 472.7 | 181.0 | 291.7 | 219.3 | 73.4 | - | - | - | 42.4 | - | 28.0 | - | 88.7 | - | - | - | 8.1 | - | 144.5 | - | - | - | - | + 6.7 | TENNESSEE |
| TEXAS | 969.0 | 471.9 | 497.1 | 474.9 | 22.2 | - | - | - | 195.6 | - | 11.1 | - | 186.3 | - | 4.3 | - | 22.5 | - | 77.3 | - | - | - | - | - | TEXAS |
| UTAH | 180.4 | 30.4 | 150.0 | 131.8 | - | 18.2 | - | - | 131.1 | 18.2 | - | - | - | - | 0.2 | - | - | - | 0.5 | - | - | - | - | -0.7 | UTAH |
| VERMONT | 139.0 | - | 139.0 | 124.0 | - | 15.0 | - | - | 100.0 | 15.0 | - | - | 7.5 | - | - | - | - | - | 16.5 | - | - | - | - | + 15.0 | VERMONT |
| VIRGINIA | 137.4 | 21.6 | 165.8 | 165.8 | - | - | 23.9 | - | 9.0 | - | 16.6 | - | 64.4 | - | - | - | - | - | 61.9 | - | - | - | - | +113.2 | VIRGINIA |
| WASHINGTON | 126.7 | 30.5 | 96.2 | 64.6 | 28.8 | 4.8 | - | - | 73.7 | 3.3 | - | - | 5.8 | - | 1.5 | - | - | - | 10.4 | 1.5 | - | - | - | + 0.4 | WASHINGTON |
| WEST VIRGINIA | 494.0 | - | 494.0 | 469.6 | 16.7 | 7.7 | - | - | 182.7 | - | - | - | 203.3 | 4.6 | - | - | 12.5 | - | 107.8 | - | - | 3.1 | - | - | WEST VIRGINIA |
| WISCONSIN | 1,016.2 | 54.2 | 962.0 | 442.4 | 162.6 | 357.1 | 19.9 | 3.6 | 299.0 | 343.5 | 33.2 | 10.0 | 3.8 | - | - | - | - | - | 249.0 | - | - | - | - | - | WISCONSIN |
| WYOMING | 233.1 | 103.7 | 129.4 | 128.0 | - | 1.4 | - | - | 129.4 | 1.4 | - | - | - | - | - | - | - | - | - | - | - | - | - | -0.7 | WYOMING |
| TOTALS | 26,662.3 | 7,060.0 | 19,492.3 | 13,663.7 | 3,182.6 | 2,646.0 | 1,132.7 | 3.6 | 9,748.0 | 2,040.9 | 743.1 | 345.1 | 1,014.6 | 117.7 | 66.7 | 8.1 | 369.7 | 11.1 | 4,339.4 | 63.9 | 81.2 | 55.2 | 0.4 | +4,541.4 | TOTALS |

NOTES: (1) HIGHWAYS UNDER CONTROL OF STATE HIGHWAY DEPARTMENTS ONLY.
(2) MILEAGE OF NEW SURFACING PLACED AND RECONSTRUCTED SURFACES SHOWN.
(3) THE FOUR COLUMNS BELOW SHOW TOTAL SURFACING PLACED DURING YEAR: MADE UP OF NEW SURFACE ON EARTH ROADS AND REPLACEMENT OF WORN OUT SURFACES, PART OF LATTER ON OTHER TYPE SURFACES AND PART AS RECONSTRUCTION OF SAME TYPE.
(4) ROADS FULLY IMPROVED TO AN ESTABLISHED GRADE AND DRAINED, READY TO SURFACE.
(5) THE NET INCREASE OF SYSTEM SURFACED MILEAGE IS REPRESENTED BY THE NEW SURFACING PLACED ON EARTH ROADS WITH ADDITIONS OR DEDUCTIONS SHOWN IN THE LAST COLUMN.
(6) THESE REVISIONS ARE COMBINATIONS OF SURFACED MILEAGE RESULTING FROM (a) LEGAL ADDITIONS TO SYSTEM (b) RELOCATION OF ROADS IN CONSTRUCTION AND (c) CORRECTIONS DUE TO RESURVEY.
(7) MILEAGE AS OF SEPTEMBER 30, 1926.
(8) MILEAGE AS OF JUNE 30, 1926.
(9) LARGE AMOUNT DUE TO LOW COST CONSTRUCTION IN WESTERN KANSAS.
(10) MILEAGE AS OF NOVEMBER 30, 1928.
(11) STONE BLOCK PAVEMENT RECONSTRUCTION
(12) REPORTED 1010.7 MILES OF LIGHT RECONSTRUCTION. NOT RECORDED HERE.

(Not for release)

# HAWAIIAN CONCRETE PAVEMENT BUILT WITH RAIN SHEDS

Contributed by H.G. McKelvey of the Division of Construction

Compiled from a report submitted by E. S. Wheeler, Senior Highway Engineer in charge of the Bureau's work in Hawaii

Rain sheds were used to protect the pavement and workmen, during unfavorable weather, in the construction of the Volcano Road - Hawaii Federal-aid project 2-B - in the district of Puna. The pavement consisted of 6.5 miles of plain concrete, 16 feet wide, and with an 8-5-8 cross section. The project terminates near the Kilauea Crater, in the southeastern sector of the territory, and forms part of a belt highway, skirting the shore-line of the Island of Hawaii.

The rainfall, which was almost incessant during part of the construction, was of such volume that some sort of protection was necessary to prevent interruption of the work. To overcome possible delays caused by the inclement weather, the contractor built a moveable shed, large enough to house the paver and finisher, and also a train of lower shed units. All of the sheds were run on rollers, bearing on the side forms, and were pulled forward at the proper time by the paver. This arrangement of moveable sheds provided cover for the laborers, and protected the green concrete until such time as the surface could not be pitted by rain; when the coat of curing soil could be applied.

The forward large shed was constructed 16 feet high in the clear, 50 feet long, and of the same width as the pavement, as shown in Figure 1-(Top). The shed was mounted on flanged wheels, gauged to fit the side forms. This main shed was large enough to house the entire mixing and finishing equipment, in addition to the laborers. For further protection, against wind and rain entering from the sides and ends, awnings were provided on three sides.

Following the large main shed and connected to it by cables was a train of 8 lower protective sheds, (figure 1-bottom), each 30 feet long and 2 feet 6 inches high, mounted in the same manner as the large shed, and covered with a cheap quality of roofing material. These minor sheds were of the flat A-type construction

FIGURE 1-(TOP)- MAIN RAIN SHED USED FOR HOUSING THE MIXER, FINISHER, AND CREW.

(BOTTOM)- TRAIN OF SMALLER SHEDS, FOLLOWING THE MAIN SHED AND PROTECTING THE CONCRETE, UNTIL THE CONCRETE IS HARD ENOUGH TO RESIST PITTING BY RAINFALL.

AND RESTED UPON LIGHT BRIDGING, PARALLEL TO THE AXIS OF THE ROAD. IN ORDER TO MAKE LAPPING POSSIBLE, EVERY ALTERNATE SHED WAS MADE 6 INCHES HIGHER THAN THE ADJACENT SHEDS. THE SHEDS WERE CABLED TOGETHER AND, AS THE PAVEMENT WAS LAID, THE ENTIRE TRAIN WAS HOOKED TO THE PAVER, OR FINISHER, AND MOVED FORWARD THE REQUIRED DISTANCE. WHERE THE GRADE WAS STEEP ENOUGH, FOR THE TRAIN TO BE MOVED BY GRAVITY, CARE WAS TAKEN TO CHOCK THE WHEELS OF THE SHEDS AFTER EVERY MOVE. IN ORDER THAT THE TRAIN MIGHT FUNCTION SMOOTHLY, AND NOT LEAVE THE SIDE FORMS, THE SHEDS WERE BUILT FAIRLY RIGID AND THE FORMS SET TRUE TO LINE AND GRADE.

IN APRIL AND MAY OF THIS YEAR, ALTHOUGH IT RAINED DAILY DURING THE CONSTRUCTION OF A PORTION OF THE PAVEMENT, NO TIME WAS LOST DUE TO WEATHER CONDITIONS, BECAUSE OF THE ADEQUATE PROTECTION AFFORDED BY THE SHEDS.

(Not for release)

# STATUS OF UNITED STATES ROUTES 75 AND 85

Contributed by F. W. Mills of the Division of Design

United States Route 75 is 71 per cent improved with gravel and the higher types of surfacing. Another 22 per cent consists of earth, and graded and drained roads, and the balance is unimproved. There are no large mileages of continuously-surfaced road on the route. The total length of the route - which almost bisects the United States in a north-and-south direction - is 1,617 miles.

A detailed statement of the condition of the road as determined by the Bureau survey follows:

## UNITED STATES ROUTE 75

| State | City or town | Type | Miles | Total |
|---|---|---|---|---|
| Minnesota | From the U.S.-Canadian boundary near Noyes | | | |
| | via Hallock | Concrete, and | | |
| | Warren | city pavement | 7.86 | |
| | Crookston | Gravel | 422.14 | |
| | Ada | Graded earth | 10.02 | 440.02 |
| | Moorhead | | | |
| | Breckenridge | | | |
| | Wheaton | | | |
| | Ortonville | | | |
| | Madison | | | |
| | Pipestone | | | |
| | Luverne | | | |
| | to Iowa State line | | | |
| Iowa | From Minn. State line | | | |
| | via Rock Rapids | Concrete, and | | |
| | Le Mars | city pavement | 54.00 | |
| | Sioux City | Gravel | 80.00 | |
| | Onawa | Graded and | | |
| | Missouri Valley | drained | 53.00 | 187.00 |
| | to Nebr. State line at Council Bluffs | | | |

UNITED STATES ROUTE 75 (CONTINUED)

| STATE | CITY OR TOWN | TYPE | MILES | TOTAL |
|---|---|---|---|---|
| NEBRASKA | FROM IOWA STATE LINE | | | |
| | AT OMAHA | | | |
| | VIA PLATTSMOUTH | GRAVEL | 70.26 | |
| | AUBURN | EARTH | 29.74 | 100.00 |
| | TO KANS. STATE LINE | | | |
| | NORTH OF SABETHA | | | |
| KANSAS | FROM NEBR. STATE LINE | | | |
| | VIA SABETHA | CONCRETE, | | |
| | TOPEKA | BRICK, AND | | |
| | CARBONDALE | CITY PAVE. | 49.5 | |
| | LYNDON | BITUMINOUS | | |
| | BURLINGTON | MACADAM | 29.5 | |
| | YATES CENTER | GRAVEL | 48.5 | |
| | NEODESHA | GRADED AND | | |
| | INDEPENDENCE | DRAINED | 78.9 | |
| | HAVANA | UNIMPROVED | 49.5 | 255.9 |
| | TO OKLA. STATE LINE | | | |
| OKLAHOMA | FROM KANS. STATE LINE | | | |
| | VIA BARTLESVILLE | CONCRETE | 77.51 | |
| | TULSA | BITUMINOUS | | |
| | SAPULPA | CONCRETE | 11.81 | |
| | OKMULGEE | GRAVEL | 50.41 | |
| | HENRYETTA | GRADED EARTH | 50.12 | |
| | WETUMKA | UNIMPROVED | 61.40 | |
| | COALGATE | | | 251.25 |
| | ATOKA | | | |
| | DURANT | | | |
| | TO TEX. STATE LINE | | | |
| TEXAS | FROM OKLA. STATE LINE | | | |
| | VIA SHERMAN | | | |
| | McKINNEY | | | |
| | DALLAS | PAVEMENT | 95.00 | |
| | CORSICANA | GRAVEL | 158.00 | |
| | BUFFALO | EARTH | 130.20 | 383.20 |
| | MADISONVILLE | | | |
| | HUNTSVILLE | | | |
| | CONROE | | | |
| | HOUSTON | | | |
| | TO GALVESTON | | | |
| | | TOTAL MILES | | 1,617.37 |

Summary of Types
United States Route 75

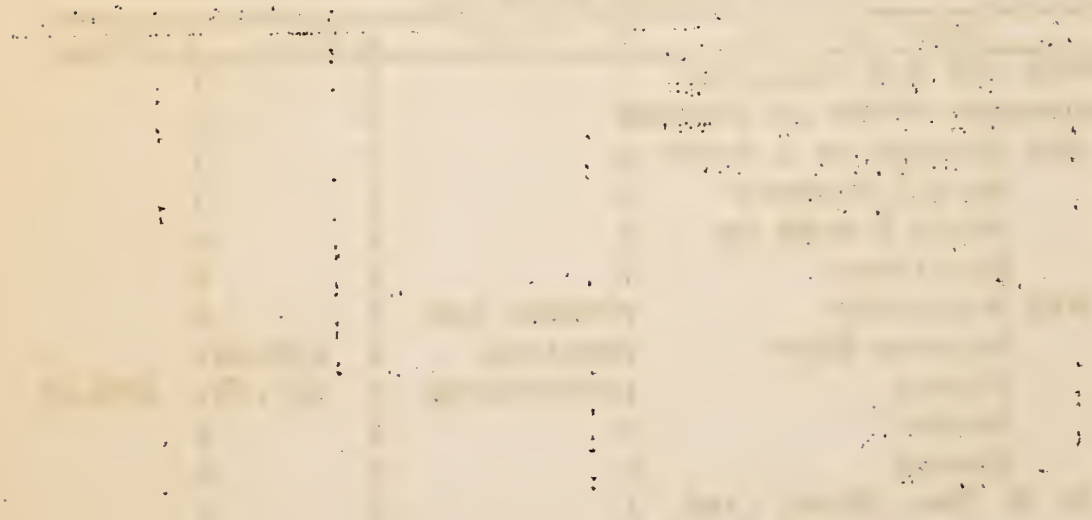
| | Miles | Per cent |
|---|---|---|
| Hard surface pavements, including concrete, city pavement, bituminous concrete and macadam | 325.18 | 20.1 |
| Gravel | 829.31 | 51.2 |
| Earth, and graded and drained roads | 351.98 | 21.8 |
| Unimproved | 110.90 | 6.9 |
| Total | 1,617.37 | 100.0 |

United States route 85 is 42 per cent improved with gravel and the higher types of surfacing. Another 32 per cent consists of bladed earth, and graded and drained roads, and the balance is unimproved. The total length of the route - which extends in a north-and-south direction, just east of the Rocky Mountains - is 1,551 miles.

A detailed statement of the condition of the road as determined by the Bureau survey follows:

UNITED STATES ROUTE 85

| State | City or town | Type | Miles | Total |
|---|---|---|---|---|
| North Dakota | From the U.S.-Canadian boundary north of Ambrose | | | |
| | via Ambrose to a point on U.S.Highway route 2 west of Williston | | | |
| | via Alexander | Graded and drained | 135.00 | |
| | Watford City | Unimproved | 121.00 | 256.00 |
| | Midway | | | |
| | Amidon | | | |
| | Bowman | | | |
| | to S. Dak. State line | | | |



UNITED STATES ROUTE 85 (CONTINUED)

| STATE | CITY OR TOWN | TYPE | MILES | TOTAL |
|---|---|---|---|---|
| SOUTH DAKOTA | FROM N.DAK. STATE LINE | | | |
| | SOUTH OF SWARTWOOD | | | |
| | VIA BUFFALO | GRAVEL | 26.03 | |
| | BELLEFOURCHE | BLADED EARTH | 34.00 | |
| | SPEARFISH | UNIMPROVED | 95.00 | 155.03 |
| | DEADWOOD | | | |
| | LEAD | | | |
| | TO WYO. STATE LINE | | | |
| WYOMING | FROM S. DAK. STATE LINE | | | |
| | SOUTHWEST OF BUCKHORN | | | |
| | VIA NEWCASTLE | GRAVEL, OR | | |
| | LUSK | SELECTED | | |
| | LINGLE | MATERIAL | 74.5 | |
| | TORRINGTON | GRADED | 157.4 | |
| | CHEYENNE | UNIMPROVED | 47.1 | 279.00 |
| | TO COLO. STATE LINE | | | |
| COLORADO | FROM WYO. STATE LINE | | | |
| | SOUTH OF CHEYENNE | | | |
| | VIA GREELEY | CONCRETE, AND | | |
| | BRIGHTON | CITY PAVEMENT | 107.86 | |
| | DENVER | BITUMINOUS | | |
| | CASTLE ROCK | MACADAM | 35.31 | |
| | COLORADO SPRINGS | GRAVEL | 110.6 | |
| | PUEBLO | GRADED EARTH | 65.23 | 319.00 |
| | WALSENBURG | | | |
| | TRINIDAD | | | |
| | TO N.MEXICO STATE LINE | | | |
| | AT RATON PASS | | | |
| NEW MEXICO | FROM COLO. STATE LINE | | | |
| | AT RATON PASS | | | |
| | VIA RATON | | | |
| | MAXWELL | | | |
| | WAGON MOUND | CONCRETE, AND | | |
| | LAS VEGAS | PAVEMENT | 55.41 | |
| | ROMEROVILLE | CRUSHED STONE | 68.82 | |
| | SANTA FE | GRAVEL | 169.07 | |
| | ALBUQUERQUE | GRADED EARTH | 100.1 | |
| | LOS LUNAS | UNIMPROVED | 148.6 | 542.00 |
| | SOCORRO | | | |
| | HOT SPRINGS | | | |
| | CABALLO | | | |
| | TO LAS CRUCES | | | |
| | | TOTAL MILES | | 1,551.03 |

## Summary of Types
## United States Route 85

| | Miles | Per cent |
|---|---|---|
| Hard surface pavements, including concrete, city pavement, and bituminous macadam | 198.58 | 12.8 |
| Gravel and crushed stone | 449.02 | 29.0 |
| Earth, bladed, and graded and drained | 491.73 | 31.7 |
| Unimproved | 411.70 | 26.5 |
| Total | 1,551.03 | 100.0 |

(Not for release)

# TESTS OF HIGH-STRENGTH CEMENTS MADE IN GERMANY

(From Der Bauingenieur, March 19, 1927, page 213)

Translated and abstracted by C. S. Jarvis, of the Division of Design

A number of tests, involving 16 brands of high-strength cement, were conducted during 1926 by the German Concrete Association. Tensile and compressive tests were made on normally dry, and sloppy mixtures of cement mortar, and gravel concrete, at 65° F., and at 32° F.; and also on cement stored for a period of 6 months. The investigations were further extended to include admixtures of tufa, a natural hydraulic cement found among the volcanic deposits so abundent along the lower Rhine.

The results of the tests indicated that:

1. The high-strength cements should reach or exceed, at 3 days, a compressive strength of 3,550 pounds per square inch; and, at 28 days, 7,100 pounds per square inch. The corresponding tensile-strength values, at 3 and 28 days, should be 355 and 640 pounds per square inch.

2. The 6-months storage of the cements caused a considerable reduction in both the tensile and compressive strengths at 3 and 28 days.

3. A freezing temperature reduced both the tensile and compressive strengths, considerably, at 3 days, but to a much lesser degree at 28 days.

4. An excessive amount of water in the mixture reduced both the tensile and compressive strengths, considerably, at 3 days, but much less at 28 days.

5. The tensile and compressive strength values of tufa cement mortar and concrete were less than those obtained with similar amounts of portland cement.

## Tests of 1:3 Cement Mortar Using Standard Sand

Mixtures of one part cement to three parts of standard sand were moistened with water equivalent to 8 per cent by weight of the

dry ingredients. Specimens molded from this mortar were tested for tensile and compressive strength at 3 and 28 days. The molded specimens were maintained one day in air and then immersed two days in water for the 3-day test; or 6 days in water, and 21 days in air for the 28 day test.

Figure 1-(Top) illustrates the minimum, average, and maximum compressive strengths for the 16 brands of cements as given in Table 1. The full lines represent the strengths attained by freshly-manufactured products, and the broken lines - indicating somewhat lower values - are for the cement stored for six months in a dry warehouse. The data show that the minimum compressive strengths recorded by the freshly-manufactured cement, at 3 and 28 days, were 3,650 and 7,530 pounds per square inch, respectively; while the corresponding average values were 4,840 and 8,900 pounds per square inch.

Figure 1-(Bottom) and the data in Table 1 show that the minimum tensile strengths of the 1:3 mixtures of freshly-manufactured cement and standard sand were, at 3 and 28 days, 370 and 640 pounds per square inch, respectively; while the corresponding average values were 442 and 717 pounds per square inch.

## Tests of 1:3 Cement Mortar Using Rhine Sand

Higher strengths were invariably obtained when Rhine sand grading from 0 to 5 millimeters (0.2 inch) was substituted in the mortar for the standard sand. The average increases in compressive strength, at 3 and 28 days, were 29 and 31 per cent respectively; with corresponding increases in tensile strength of 41 and 23 per cent.

## Tests of Concrete Mixtures

Tests were then made of the high-strength cements in concrete mixed in the proportions of $1:2\frac{1}{2}:2\frac{1}{2}$ by volume. The fine and coarse aggregates were obtained by screening river gravel into sizes varying from 0 to 5 millimeters (0.2 inch), and from 5 to 20 millimeters (0.79 inch). For compressive tests on each brand of cement, there were prepared twelve 8-inch cubical specimens, mixed with $9\frac{1}{2}$ per cent of water to produce a relatively dry concrete. Another 12 specimens were mixed with $15\frac{1}{2}$ per cent of water to produce a sloppy concrete. The forms were removed after being under a moist covering for the first 24 hours. One half of the test specimens were then cured in air at ordinary temperatures, $57^{\circ}$ to $68^{\circ}$ F., and the other samples were kept in cold storage at $32^{\circ}$ F.

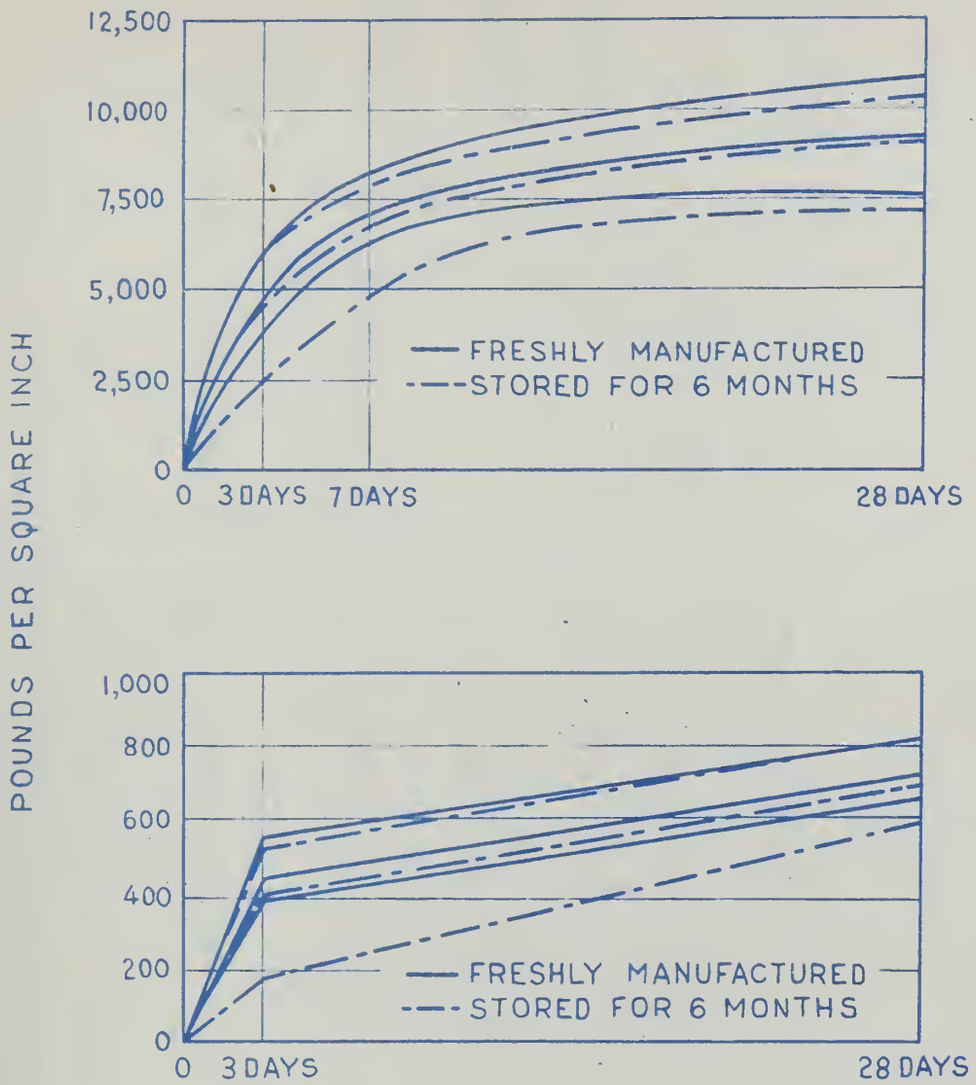



FIGURE 1 - (TOP) - MAXIMUM, MEAN, AND MINIMUM COMPRESSIVE STRENGTH OF 16 SAMPLES OF HIGH-STRENGTH CEMENT.

(BOTTOM) - MAXIMUM, MEAN, AND MINIMUM TENSILE STRENGTH OF 16 SAMPLES OF HIGH-STRENGTH CEMENT.

TABLE 1. - TENSILE AND COMPRESSIVE STRENGTHS OF SEVERAL GERMAN HIGH-STRENGTH PORTLAND CEMENTS

| PROPORTIONS | AGGREGATE | COMPRESSIVE STRENGTH IN POUNDS PER SQUARE INCH | | | | TENSILE STRENGTH IN POUNDS PER SQUARE INCH | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | MINIMUM | | AVERAGE | | MINIMUM | | AVERAGE | | |
| | | 3 DAYS | 28 DAYS | 3 DAYS | 28 DAYS | 3 DAYS | 28 DAYS | 3 DAYS | 28 DAYS | |
| 1:3 | STANDARD SAND | 3,850 | 7,530 | 4,840 | 8,900 | 370 | 640 | 442 | 717 | FRESH CEMENT; CURED AT 65°F. |
| 1:3 | DO | 2,280 | 6,980 | 4,270 | 8,840 | 178 | 584 | 392 | 684 | CEMENT USED AFTER 6-MONTHS STORAGE; CURED AT 65°F. |
| 1:3 | RHINE SAND | -- | -- | 6,250 | 11,660 | -- | -- | 624 | 882 | FRESH CEMENT; CURED AT 65°F. |
| 1:2½:2½ WATER 9½ PER CENT | RHINE SAND AND GRAVEL | -- | 3,920 | 2,710 | 4,720 | -- | -- | -- | -- | FRESH CEMENT; CURED AT 65°F. |
| DO | DO | -- | -- | 1,815 | 4,200 | -- | -- | -- | -- | CURED AT 32°F. |
| DO | DO | -- | -- | 1,490 | 3,260 | -- | -- | -- | -- | CEMENT STORED 6 MONTHS; CURED AT 65°F. |
| 1:2½:2½ WATER 15½ PER CENT | RHINE SAND AND GRAVEL | -- | 1,851 | 1,112 | 3,110 | -- | -- | -- | -- | FRESH CEMENT; CURED AT 65°F. |
| DO | DO | -- | -- | 656 | 2,700 | -- | -- | -- | -- | CURED AT 32°F. |
| DO | DO | -- | -- | 635 | 1,830 | -- | -- | -- | -- | CEMENT STORED 6 MONTHS; CURED AT 65°F. |

Table 1 gives the results of all the tests as reported except that the values are expressed in the English equivalents of the metric units. The data indicate that the dry concrete, cured at an ordinary temperature, attained a minimum strength at 28 days of 3,920 pounds per square inch, with an average strength of 4,720 pounds per square inch; while the corresponding figures for the sloppy concrete were 1,851 and 3,110 pounds per square inch, or 61 and 89 per cent of the dry-concrete values, respectively. The dry-concrete specimens cured at 32° F., attained strength equaling, at 3 and 28 days, 67 and 89 per cent, respectively, of the mixtures of a similar consistency cured at 65° F. The sloppy-concrete specimens, at 3 and 28 days, attained values of 59 and 87 per cent, respectively, of the mixtures of similar consistency cured at 65° F. These figures indicate that the effects of low temperatures and high moisture contents are more pronounced during the first few days of curing. The various brands of cement showed practically the same resistance to low temperatures.

The experiments with concrete cured at normal temperatures were then duplicated with the same brands of cements after 6 months of dry storage. The lumps, that had formed while in storage, were not removed, and the cement was used just as it was found. The resulting strengths for the dry mix, at 3 and 28 days, were 55 and 69 per cent, respectively, of the results secured with the freshly-manufactured product; while the corresponding values for the sloppy concrete were 57 and 59 per cent.

## Tests of Tufa Cement

In connection with the foregoing experiments, tests were conducted on tufa cement taken from volcanic deposits so abundant along the lower Rhine.

The normal Portland cement, such as was used in the foregoing tests, was called Cement A; the substitution of tufa cement for 20 per cent of normal cement was called Cement B; and the addition of one-third of a bag of tufa to one bag of Portland cement constituted Cement C. In all the mixtures in this series of tests, 1-1/3 parts Cement C were compared with one part of either Cement A or Cement B.

The data in Table 2 indicate that tufa cement mortar, and concrete, showed less tensile and compressive strength than mortar, or concrete, made with similar proportions of Portland cement. The

TABLE 2. - TENSILE AND COMPRESSIVE STRENGTHS OF TUFA CEMENT AS COMPARED WITH PORTLAND CEMENT

| PROPORTIONS | AGGREGATE | AVERAGE COMPRESSIVE STRENGTH IN POUNDS PER SQUARE INCH | | AVERAGE TENSILE STRENGTH IN POUNDS PER SQUARE INCH | | REMARKS |
|---|---|---|---|---|---|---|
| | | 3 DAYS | 28 DAYS | 3 DAYS | 28 DAYS | |
| 1:3 WATER 8 PER CENT | STANDARD SAND | 3,000 | 7,700 | 328 | 655 | PORTLAND CEMENT A; CURED AT 65°F. |
| Do | Do | 2,700 | 6,850 | 250 | 700 | TUFA CEMENT B; CURED AT 65°F. |
| 1:1/3:3 | Do | 3,280 | 9,050 | 378 | 784 | TUFA CEMENT C; CURED AT 65°F. |
| 1:3 WATER 8 PER CENT | RHINE SAND | 4,200 | 9,850 | 485 | 798 | PORTLAND CEMENT A; CURED AT 65°F. |
| Do | Do | 4,350 | 7,700 | 335 | 805 | TUFA CEMENT B; CURED AT 65°F. |
| 1-1/3:3 | Do | 3,060 | 8,850 | 399 | 784 | TUFA CEMENT C; CURED AT 65°F. |
| 1:2½:2½ | RHINE SAND AND GRAVEL | 2,500 | 4,200 | --- | --- | PORTLAND CEMENT A; CURED AT 65°F. |
| Do | Do | 1,710 | 4,230 | --- | --- | PORTLAND CEMENT A; CURED AT 32°F. |
| 1:2½:2½ | Do | 1,400 | 3,020 | --- | --- | TUFA CEMENT B; CURED AT 65°F. |
| Do | Do | 840 | 3,000 | --- | --- | TUFA CEMENT B; CURED AT 32°F. |
| 1-1/3:2½:2½ | Do | 1,425 | 3,500 | --- | --- | TUFA CEMENT C; CURED AT 65°F. |
| Do | Do | 940 | 3,130 | --- | --- | TUFA CEMENT C; CURED AT 32°F. |

INCREASED RICHNESS OF MIXTURES CONTAINING CEMENT C PRODUCED GREATER STRENGTH IN THE MORTARS MADE WITH STANDARD SAND, AS COMPARED WITH THE STANDARD PORTLAND-CEMENT MIXTURE; BUT SHOWED LESS STRENGTH IN THE MORTARS CONSTRUCTED WITH RHINE SAND. THE 1-1/3: 2-1/2:2-1/2 CONCRETE MIX WITH CEMENT C ALSO SHOWED CONSIDERABLY LESS STRENGTH THAN THE SAME MIX WITH CEMENT A.